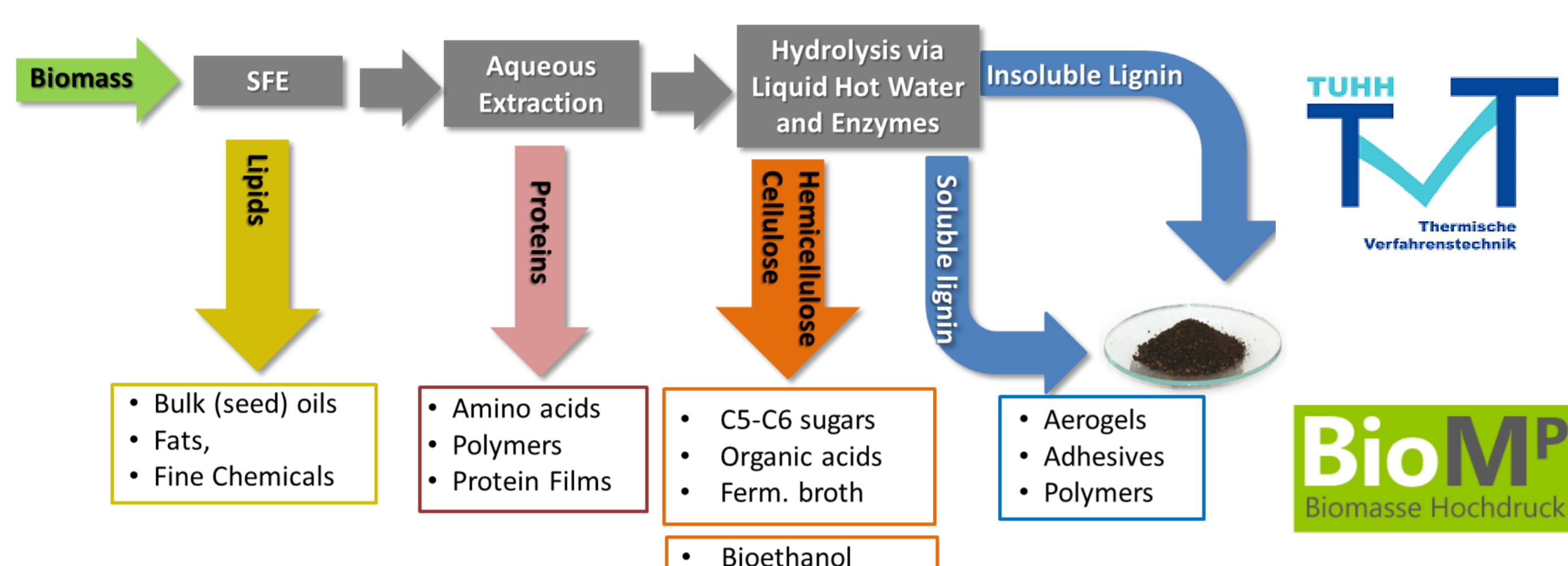


## Introduction

- The limited availability of fossil raw materials and the increasing energy demand require a more intensive use of the great potentials of biomass in the future.
- In this context, especially linked conversion pathways for the energetic and substantial utilization of biomass, a so-called cascaded utilization, are a promising approach.

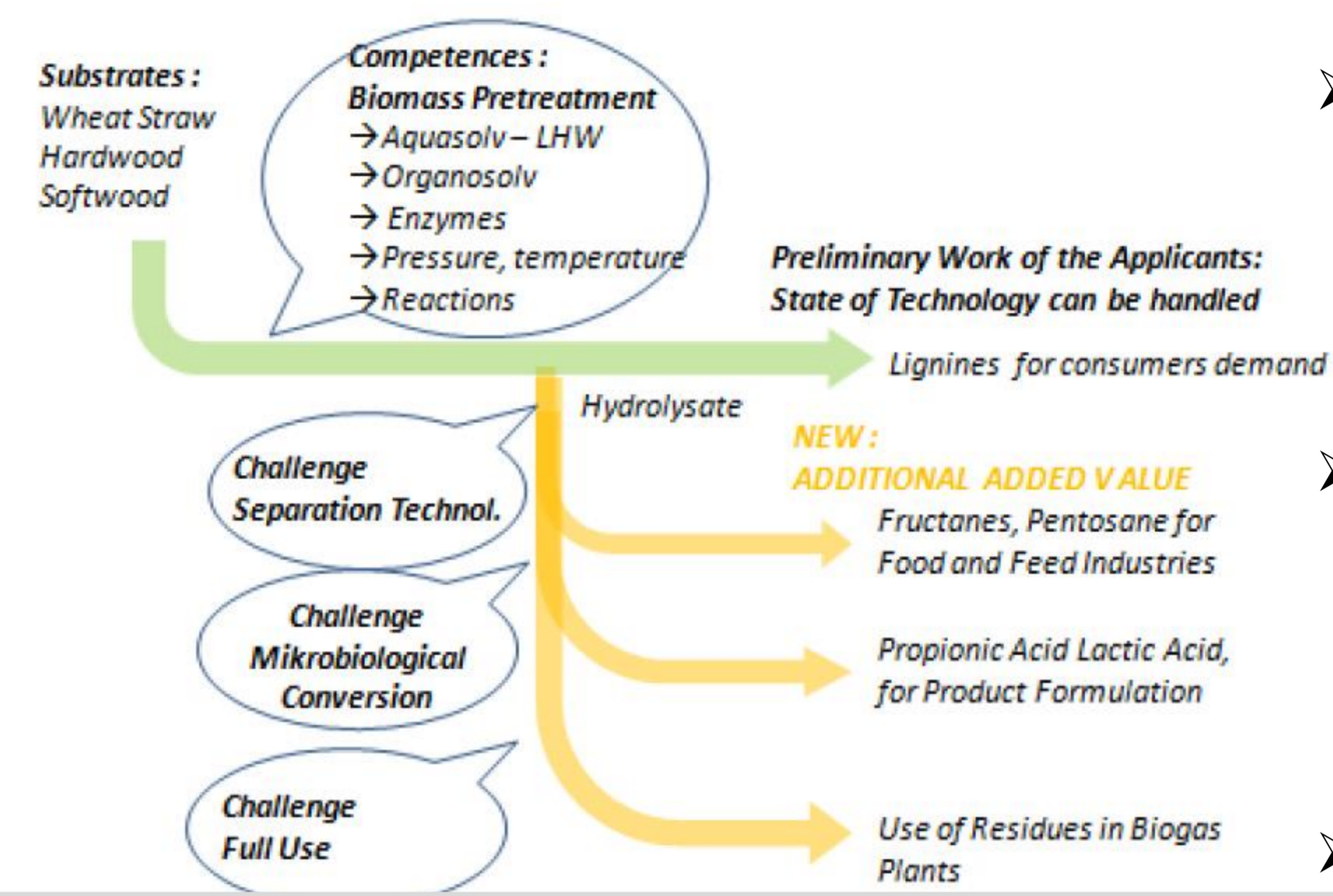


## ELBE-NH project aims

- Main goal in the **ELBE-NH project** [1-3], running from 2019 to 2021, is the utilization of the liquid hot water hydrolysates from lignocellulosic biomass, which -until now- were extracted as by-products from the main stream of a **lignin biorefinery**.

### New Target products

- primarily lactic acid and **propionic acid** (microbiological conversion of the hydrolysates)
- fructans and pentosans (separation from hydrolysates by chromatographic methods)
- biogas



## Materials and Methods

### Test the possibility of

(a) **additive** incorporated direct into texture-defined bread product:

- encapsulated hydrophilic PA (0.3% w/v) into  $\beta$ -cyclodextrin ( $\beta$ -CD)/maltodextrin blends as the wall materials (19:1 or 17:3% w/v) spray-dried;

(b) **packaging material** to enhance the safety and shelf life of texture-defined bread product:

- polysaccharide-based (e.g. carboxymethylcellulose (2% w/v) or chitosan (2% w/v)) biodegradation-resistant edible film (as carriers of PA antimicrobial agent (1.5-15% w/v)) with/without addition of  $\beta$ -CD (5% w/v) to the film matrix

### Propionic acid - propionates (E 280- 283)

- authorised food additives in the EU in accordance with Annex II of Regulation (EC) No 1333/2008
- packaged, sliced bread (max. 3 g / kg)/prepacked, pre-baked bread for baking (max. 2 g / kg) [4,5]

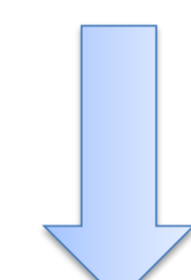
### Texture-defined bread

- soft gel-like structure bread, easy to swallow and can be consumed without chewing, for people suffering from swallowing and chewing disorders
- high protein content up to 15 % higher than that of conventional bread, contribution to combating malnutrition

## Intermediate Results

### A. Encapsulated hydrophilic PA

### B. Texture-defined bread



The following parameters are examined:

- Solubility of the powder in bread
- Bread taste and mouthfeel
- Gel strength / cut resistance of the bread

In further experiments:

- clarified whether the alternative ingredients used can replace the currently used ingredients in the recipe and what effect this will have on the final gelled bread

## Acknowledgement

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### Literature:

- [1] <https://www.tuhh.de/v8/research/elbe-nh.html>
- [2] <https://bioraffinerie2021.de/en/>
- [3] <https://www.tuhh.de/v8/prof-smirnova/forschungsthemen/thermisch-enzymatische-hydrolyse.html>
- [4] <https://efsa.onlinelibrary.wiley.com/doi/pdf/10.2903/j.efsa.2014.3779>
- [5] [https://www.zusatzstoffe-online.de/zusatzstoffe/85.e280\\_propions%E4ure.html](https://www.zusatzstoffe-online.de/zusatzstoffe/85.e280_propions%E4ure.html)

### ELBE-NH project Coordinator:

Hamburg University of Technology  
Institute of Thermal Separation Processes  
[www.tuhh.de/v8](http://www.tuhh.de/v8)